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The Demand for Base Money and the Sustainability of Public Debt

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Anything policymakers can do to increase the demand for base money will help solve public debt problems.

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Summary findings

Key (related) factors in an analysis of debt sustainability should include:

- The demand for base money (or high-powered money).
- Projected fiscal balance.
- The real interest rate.
- The rate of income growth.

Garcia emphasizes the demand for base money, a variable that has received scant attention in the literature of fiscal debt sustainability.

Given a constant base multiplier, the demand for real base money goes hand-in-hand with the demand for money. In fact, if we adjust the stock of money for changes in the base multiplier, shifts in the monetary base have to mirror changes in the money stock; and anything that changes the demand for money will also change the demand for base money.

Consequently, a change in the expected cost of holding money, a change in permanent income, or a change in regime—which would no doubt affect the demand for

real money—would also affect the real stock of base money. Naturally, base multipliers are not constant and more research on the relative stability of base money in debt ridden countries is warranted.

Real interest rates are also important. Many Latin American countries have issued domestic bonds to sterilize the effect of capital inflows on the real exchange rate and, consequently, have significantly increased their real interest rate burden affecting their debt sustainability.

Permanently increasing the fiscal surplus would improve debt sustainability if other variables remain unchanged. Furthermore, Garcia claims that a permanent increase in the fiscal primary surplus through expenditure reduction would have an important effect on debt sustainability because it would reduce real interest rates (less crowding out), increase income growth (allocation effect), and increase demand for monetary base (reduced inflation expectations and higher expected income growth).

This paper — a product of the Economic Adviser's Unit, Latin America and the Caribbean, Office of the Regional Vice President — is part of a larger effort in the region to address debt and fiscal issues. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Jorge Forgues, room 18-449, telephone 202-473-9774, fax 202-676-9271, Internet address jforgues@worldbank.org. June 1997. (36 pages)

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The Demand for Base Money and the Sustainability of Public Debt

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Executive Summary

At the core of the debt sustainability analysis is the demand for real monetary base, the primary fiscal surplus, the real interest rate, and the rate of income growth, all of which are mutually determined by other variables. This paper puts special emphasis on one such variable virtually disregarded in current literature on debt sustainability — the demand for monetary base. Any effort by policymakers to instill confidence in such a way as to secure an increased demand for the monetary base would be a step forward to solving the debt dilemma.

Given a constant base multiplier, the demand for real base money (or high-powered money) goes hand in hand with the demand for money. In fact, if we adjust the stock of money for changes in the base multiplier, shifts in the former will mirror changes in base money; and anything that changes the demand for money will also change the demand for base money. This is a basic matter of arithmetic. Consequently, a change in the expected cost of holding money, a change in wealth (or permanent real income), or a change in regime — which would no doubt affect the demand for real money — would also affect the real stock of base money.

In this sense financial deepening would go hand in hand with real high-powered money, increasing the amount of debt that is sustainable. This is explained by the fact that as financial deepening increases the real base, it would simultaneously increase seignorage.

Even correctly assuming that the multipliers are not constant², there is evidence that there is a stable demand for high-powered money. In fact, high-powered money competes with other conventional measures of money (M1, M2...Mn) regarding its relative stability, and

¹ This paper was motivated by Guillermo Perry, whom I thank for his excellent suggestions. I would also like to thank Saul Lizondo for his extensive and valuable comments and the research assistantship of Beatriz Alonzo. Naturally, I am solely responsible for the opinions expressed and any possible errors. The findings, interpretations and conclusions expressed are those of the author and should not in any manner be attributed to the World Bank or its affiliated institutions.

² The multipliers can in fact depict high variability and significant trend; their most important determinants are the cash-to-deposit ratio and the reserve requirements ratio. In normal circumstances, the annual average cash-to-deposit ratio tends to change gradually, and (unfortunately) as a general rule, it has been the reserve requirements ratio which has been most widely changed by policymakers.

may even be a “better” definition of money. The problem with conventional definitions of money is that their empirical determinants are different, according to the degree of “moneyness” of its components.

These problems led James Lothian (1976) to focus on the demand for monetary base: *“The solution that I propose... is to return to a narrower definition of money, high-powered money alone.... The demand for high-powered money should be more stable than the demand for other monetary aggregates.... I test this proposition by analyzing the demand functions for high-powered money and for various other monetary assets estimated across an international time-section sample spanning forty countries in the postwar period.... I find that high-powered money is unambiguously the most stable total across countries in my sample.”*

High interest rates on domestic debt are also an issue of concern. Many Latin American countries are switching to (domestic) debt financing as a means of sterilizing the effect of capital inflows on the real exchange rate. Yet, this trend may, in turn, affect the sustainability of their debt through its impact on the real interest rate and reduced income growth (because high interest rates depress economic activity). Its ramifications may also extend to the demand for real base if the induced higher operational deficit generates inflationary expectations.

Primary fiscal surplus is a key variable in the calculation of sustainability. A permanent increase in the primary fiscal surplus would increase debt sustainability if other variables remain unchanged. Furthermore, a permanent increase in the fiscal primary surplus *through expenditure reduction* would have an important effect on debt sustainability given its tendency to:

- reduce the real interest rate (through crowding out reduction)
- increase income growth (through increased efficiency in resource allocation and reduced interest rates)
- increase the demand for monetary base (as a result of reduced inflationary expectations).

Most countries in search of fiscal solvency have stressed increased taxation while doing little to reduce expenditures. However, higher tax revenues have frequently led to higher expenditures. In fact, the general trend in the Western World has been to increase expenditures which has been blamed for increasing the fiscal gap in the industrial countries³. The increase has indeed been striking: from 1960 through 1994 the ratio of government expenditures to GDP in these countries rose to 50 percent from its previous 28 percent, while tax revenues increased from 28 to 44 percent.

³ On this issue, see Lindauer, (1988); McDermott and Wescott (1996).

The issue is important given the fact that changes in tax revenues or in government expenditures have different effects on the real economy. Even equal increments in tax revenues and expenditure would have a non-neutral effect according to conventional (text-book) analysis of the balance budget multiplier⁴. For example, in a full employment situation a balance budget multiplier would lead to increments in interest rates. Consequently, in adjusting the fiscal accounts to achieve debt sustainability, the composition of the fiscal adjustment would be a critical variable.

⁴ The balance budget multiplier would be smaller (instead of the text-book case of one) if the public substitutes the incremental public expenditures in goods and services with a reduction in its expenditure. If substitution is perfect the balance budget multiplier would be zero (Bailey 1971).

Public Debt Sustainability and Demand for Monetary Base

The growing interest in debt sustainability is traced to distinct world experiences with domestic and external debt defaults or quasi-defaults, at times coupled with banking crises and the threat of economic collapse.

One face of change in a country's international position can be gauged by the current account deficit — a measurement of the net capital inflows from abroad. The aftermath of the 1994 -95 Mexican meltdown inspired a flood of literature discussing the sustainability of current account deficits. Another such face of change is the fiscal deficit — a measurement of the increment in government borrowing (including interest and non-interest bearing debt).

This paper will deal with the latter issue — the sustainability of public debt. This has been a matter of great interest as a result of the myriad episodes of quasi-defaults, which include the relatively recent Latin American debt crises, triggered in 1982 by the Mexican default, and later the Argentine (1990) and Brazilian (1991) episodes.

Public debt can be defined as stock resulting from the accumulation of the flow of public sector deficits. The sustainability of this stock has been discussed in economic literature in the context of government inter-temporal budgetary constraints: looking at the flow of future fiscal primary surpluses, the expected real interest rate, etc.

Governments have two ways of complying with budget constraints — issuing money or debt⁵. In this context, the Treasury would be solvent if the present value of future *primary* surpluses (excluding interest payments) equals the stock of its outstanding debt (Hamilton and Flavin 1986; Caporale 1993). A sufficient condition for solvency is that the debt to income ratio be less or equal to the present value of primary surpluses, with the discount factor equal to the real interest rate, minus the rate of real income growth. It is not enough to look at the trend of debt to income ratio; the critical factor is whether there will be a convergence to a steady state.

In the former test, the discount factor is the (expected) real interest rate, while in the latter the discount factor is the difference between the (expected) real interest rate and the (expected) income growth. If this present value is equal or higher than the current debt to GDP ratio, the debt is assumed to be sustainable.

A distinction is sometimes made between **government solvency** and **fiscal sustainability** (Horne 1991). This distinction is important because the government solvency criteria is broader: it takes into account the government's net worth. A government is *solvent* if it has a positive net worth: the discounted value of its overall income flowing from all its assets, minus its total expenditure flow, is positive. Ex-ante a government may be

⁵ In a strict sense everything is debt. Money is only a special kind of non-interest bearing debt.

bankrupt, but ex-post it will be able to pay its debts via debt default or higher direct or indirect taxation (inflation tax).

A narrower criteria when assessing debt convergence would only consider the economic situation of the government's Treasury. Naturally, given these definitions and assuming positive income growth, a sufficient condition for the sustainability of the Treasury's debt would entail that it generate a permanent stream of positive *operational*⁶ surpluses.

The most utilized variables in assessing debt sustainability are the fiscal primary surplus, real interest rate and the rate of GDP growth. Within this set we could focus on the Treasury and evaluate, for example, the projected level of government revenues⁷ relative to its debt burden. The evaluation of the financial and economic capacity of the Treasury should be no different than that of a private enterprise. For example, the ratio of debt and debt service to public savings could be a good indicator of the fiscal burden of the debt.

There are several formulas to quantify debt sustainability, although most are based on different variants of government budget constraints. Ghani and Zang (1995), following Branson (1990), use the following formula to assess debt sustainability in Ethiopia:

$$db = (r - n) b + p - s$$

where b is the ratio of debt to GDP, db is its rate of growth, r is the real interest rate, n the growth rate of real GDP, p is the primary deficit (ratio to GDP), and s is the ratio of seignorage (including inflation tax) to GDP. In this formula different assumptions are made for the time path of primary surplus, seignorage, interest rate and income growth in order to map the change in debt, as well as to determine whether it is sustainable through the usual present value technique.

Privatization

Many governments in LAC have launched ambitious privatization programs. Particularly important have been those of Chile, Bolivia, Argentina and Peru. Although Brazil's program has been relatively slow, it has already managed to sell assets valued near \$5 bn, and is in the process of accelerating its divestiture program with the privatization of the giant Companhia do Vale do Rio Doce. Mexico and Venezuela have also made significant strides in this direction. The lingering question, however, is how to treat the privatization proceedings in the context of debt sustainability.

Privatization can have a significant effect on debt sustainability if proceeds from the sale of insolvent public enterprises are applied to pay off public debt, and inasmuch as these privatized entities will be a new source of tax revenue. Privatization improves the

⁶ The operational surplus is equal to the primary surplus, minus the real component of interests payments.

⁷ There are other variables that sometimes are used to refine projections, like expected seignorage, privatization proceeds etc.

Treasury's net worth if the following conditions are met: the sale value of the public enterprise, plus the present value of future taxes from the latter, minus government expenditures to put the enterprise on the market exceeds the present value of future losses (if not privatized).

Conversely, privatization may have no effect on debt sustainability. If the enterprise was profitable and the net income flowing from the stock to be privatized was included in the fiscal primary balance, there would be no difference in the debt sustainability exercise if that income flow is reduced, but the proceeds from privatization are used to reduce the stock of debt⁸.

For most countries the flow of income from public sector enterprises is not included in Treasury revenue flows. Many of these enterprises either generate losses or their profits accrue only to the enterprise⁹.

Debt: gross or net?

Another issue is the correct measurement of debt. For example, if the central bank issues debt in order to sterilize capital inflows, should there be any change in relevant debt statistics? What if debt is issued to buy a non-financial asset? This is not a minor issue. Country after country in Latin America, in one way or another, has issued a significant amount of debt in order to sterilize capital inflows. Brazil and Chile are prime examples, engaging in zealous sterilization practices.

In the case of foreign exchange purchases, an advisable approach would be to deduct them from gross debt, given that in the primary surplus, interest earned on those reserves is ignored. Non-financial assets are different. They could be useful when assessing government solvency but would complicate matters if net out in the debt sustainability exercise.

Moreover, implicating non-financial assets may muddle calculations. There are instances in which it may be difficult to value the asset counterpart of debt. For example, the central bank grants a rediscount to troubled banks, assumes a portion of the latter's assets as a guarantee, and sterilizes the monetary effect by issuing debt. Should this debt increment be offset by the seizure of commercial bank assets? What percentage of the rediscount would be paid back? In this example, the difficulty comes from the lack of indicators of the market value of commercial bank assets seized by the central bank.

Regarding the use of net or gross figures for debt analysis, a distinction should be drawn between financial and non-financial assets.

⁸ Given the interest rates, any stock can be converted into a flow and vice-versa.

⁹ A classic counterexample would be Venezuela where a large share of PDVESA profits go to the government coffers. This is not the usual case in Latin America.

Standard financial assets Interest rate earnings on the Treasury's standard financial assets should not be included as fiscal revenues, and the stock of those financial assets should be deducted from the stock of debt. In this sense debt is net of other financial assets.

Non-financial assets: These may be different in view of the fact that their return may be counted as fiscal revenues. If this is the case, the stock value of these non-financial assets should not be netted-out from the stock of debt.

The most conservative approach to the gross-net debt issue is to net out only standard financial assets whose returns have been excluded in the fiscal revenues. All other items should be omitted, including those financial assets taken over from commercial banks.

Contingent liabilities

The Treasury may have to contend with a host of contingent liabilities; such as, deposit insurance of the entire banking system, liabilities belonging to certain government-managed insolvent banks, social security debt, debt guarantees including States' debt guarantee by the federal government, etc. Some of these liabilities are not contingent but rather actual short-term net debt; for example, the red ink on commercial banks taken over and managed by the central bank or a government agency.

How are contingent liabilities accounted for? One approach would be to confine them to government solvency estimates and not to debt sustainability. Another more conservative option would be to include a small percentage of contingent liabilities as a part of Treasury's total debt.

Some difficulties with primary fiscal surpluses

The inherent problem in the approach comparing the primary surplus and its present value with the stock of debt is using the "right" real interest rate, which in turn depends on the structure of the surpluses. The same fiscal surplus could be consistent with an infinite path of expenditures and revenues; consequently, the pattern of outlays, savings and interest rate would differ, even though the deficit is the same. As Ghani and Zang aptly put it (1995): "debt sustainability (both domestic and external) is an integral element of macroeconomic stability. Interactions between different policy variables (such as debt, fiscal and interest rate policies), and outcome variables (such as GDP and export growth), as well as international economic conditions (international interest rates) jointly define if the country is on a sustainable debt path."

Under Ricardian¹⁰ equivalencies the crucial variable is not the deficit but rather expenditures. Public expenditures is the amount of resources that in fact crowd out the

¹⁰ Although Ricardian equivalencies must stand the test of strict assumptions, it does not prevent it from shedding light on the crucial role of government expenditures relative to that of the fiscal deficit. Ricardian equivalence would hold true if taxes were lump sum, capital markets were perfect and all individuals had operative altruistic motives. Under these assumptions, for a given path of expenditures, debt and tax

private sector. How they are financed (debt or taxes) would be, under Ricardian equivalence, of no real importance regarding real variables. Market interest rates on government debt would be less, the lower the government expenditures. This would be true even if lower expenditures were coupled with a higher debt-financed deficit. The level of government spending might be a crucial variable in determining debt sustainability (through its impact on interest rates).

In this regard, a country could find that a smaller primary surplus, produced by a more than proportional fall in the tax burden over expenditures, may actually make its debt sustainable if the impact of reduced expenditures on real interest rates is large enough. In this sense, more empirical research on the effect of government expenditure on interest rates would be essential.

The current real interest on government debt provides a valuable summary indicator of market expectations regarding fiscal solvency. Different time structures of government debt and varied debt indexations (including indexing to the exchange rate) can affect the real interest rates on the debt insofar as the indexation rule affects the fiscal position of the government, and the market perceives a different probability of default for different types of debt in the government's debt menu. In this sense, and to a limited extent, some financial engineering may be able to change some of the real conditions of public debt.

The current observed interest rate on government bonds may not be representative of the "long-term equilibrium" rate, due to monetary policy shocks. The central bank may elect to pursue a *temporary* "tight" policy; consequently, the interest rate may not necessarily reflect its long-term "permanent" value for the nation's given set of economic parameters. Furthermore, the government's "risk premium" may be affected by short-term forces. Naturally, if central banks follow a "tight" monetary policy long enough, this could turn the current interest rate into a relevant figure in the calculation of sustainability.

The lower the probability that debt will be sustainable, the higher the interest rates and the shorter its time-structure. In other words, the higher the interest rate, the higher the probability that debt will be unsustainable. If the latter is the case, the market will take for granted that in time government will redefine its fiscal policy — either increasing taxes, reducing expenditures, repudiating debt or increasing the inflation tax.

The long-run "equilibrium" interest rate on government debt is an estimate of the likelihood of the expected value of future primary surpluses to equal the current stock of debt. The observed market interest rate is made up of the basic risk-free equilibrium rate, plus "government" risk (including the probability of default), plus (or minus) temporary shocks.

finance would be equivalent. In the words of Obstfeld and Rogoff (1996) "...Given the path of government spending, a transfer of foreign assets from a country's private sector to its government, say, would cause tax cuts just sufficient to leave the present value of private disposable income unchanged."

Given all the conceptual and empirical problems with the “right” measurement of debt, interest rates, and fiscal revenues and expenditures, an adequate empirical assessment of debt sustainability would include the market value of debt (assuming there is a secondary market)¹¹. The market value of government debt is equal to the present value of the share of *expected fiscal* surplus that is *expected* to be applied to debt amortization.

Consequently, a rule of thumb in assessing sustainability, is that if the market value of the Treasury’s debt is lower than the present value of promised interest payments (plus principal), the face value of debt is unsustainable. The difference between the market value and the face value is the measurement of tax (including partial default) that has not been explicitly “budgeted.”

Income Velocity of Base Money and the Debt-Inflation Choice

Although this paper takes into account seignorage and the inflation tax as a source of revenue when defining the budget constraint, it has yet to emphasize the importance of income velocity of base money in a country’s choice between debt and inflation. Income velocity plays a crucial role in the inflationary (deflationary) impact of debt vis-à-vis monetary financing of the primary deficit.

We define:

i nominal interest rate

y real income

B stock of bonds outstanding

H monetary base

P price level

E public sector non-interest expenditures

R public sector non-interest revenues

PSBR = E-R + iB (public sector borrowing requirements)

D = PSBR - iB (Primary balance, deficit when positive; a surplus when negative)

OD = D + rB (Operational balance)

k = 1/V ratio of monetary base to GDP

Z denotes increment

g preceding a variable denotes its rate of change

lower case letter refer to ratios to GDP

r = ((1+i)/(1+gP)) (-1) real rate of interest

$$(1) \quad D = E - R$$

$$(2) \quad D + iB = ZB + ZH \quad (\text{PSBR})$$

¹¹ This in fact is the same as looking at the market interest rate on such debt .

Dividing (2) by GDP, dividing and multiplying ZB by B and ZH by H and assuming $gP = gH - gy$, results in:

$$(3) \quad d + ib = b gB + k gP + k gy$$

$$(4) \quad gP = Vd + Vb i - Vb gB - gy$$

$$(5) \quad gP = Vd + Vb (i - gB) - gy$$

defining the public sector borrowing requirements as $ps = d + bi$,
and the real increment in government bonds as $(ZB/Y) = zB$,
we obtain from (5):

$$(6) \quad gP = V ps - V zB - gy$$

$$(7) \quad gP = V (ps - zB) - gy$$

Equation (7) shows two important features: (1) two countries with the same ratio of public sector borrowing requirements to GDP (ps) may have a completely different inflation rate, depending on their income velocity of base money; and (2) the higher the income velocity of base money, the higher the incentive to increase debt (zB). If zB is larger than ps , the indication is that the nominal supply of money is being reduced, and consequently deflation is expected.

Equation (5) expresses the same proposition in a different light: the impact of bond financing on inflation is negative if the rate of change in the nominal stock of bonds is higher than the nominal interest rate. This situation is consistent with the classical Ponzi game in which new bonds are issued to pay incurred interest rates. The higher the income velocity of base money, the greater the temptation to resort to these Ponzi games.

Debt sustainability

using $i = r + gP$, assuming debt sustainability is defined as $gB = gP + gy$ and substituting them into (3), we get:

$$(8) \quad d + br = k gP + b gy + k gy$$

$$(9) \quad gP = Vd + Vb (r - gy) - gy$$

re-arranging (9), we obtain:

$$(10) \quad gP = V [d + b (r - gy)] - gy$$

Equation (10) shows the basic elements of the well-known quantitative theory of money: inflation depends on velocity (V), money supply (d+rb) and real income growth.

From equation (8) solving for **b**, we obtain:

$$(11) \quad b = (k gP + k gy - d) / (r - gy)$$

Equation (11) shows that, *ceteris paribus*, the sustainable debt ratio (b) will be higher, the greater the inflation rate (due to the inflation tax) and the greater the income growth. In fact $k (gP + gy)$ measures government revenue from money creation, which is an inverse function of income velocity of money: the higher the income velocity, the lower the government revenue from money creation. Also, according to equation (11) a fiscal surplus (negative d) will have a positive effect on the amount of sustainable debt.

The denominator of equation (11) is the difference between the real rate of interest and the real rate of economic growth. In the “normal” case, the interest rate is higher than the rate of income growth, but in the opposite case a primary surplus is not needed to achieve sustainability. The government could run primary deficits of any size which would be consistent with a sustainable debt ratio (Blanchard et. al. 1990).

The equilibrium value of constant debt (b) will be lower, the lower the primary surplus¹² and the higher the real interest rate. Real income growth plays a double role inasmuch as it is a source of seignorage to government and increases the denominator of the debt ratio.

Seignorage

Seignorage is particularly important and is exhibited in equation (11) as real base money (k) multiplied by the rate of inflation and the rate of real income growth.

¹² If there is a sustainable debt figure, despite of a primary deficit, it is due to the tax revenue from money creation.

Applying equation (11) to the following “reasonable” 1997 value parameters for Brazil, we obtain a “reasonable” $b = 0.17$

$$k = .06; \quad gP = .07; \quad r = .09; \quad gy = .04; \quad d = -.002 \text{ (primary surplus)}$$

Brazil has evidently planned a higher primary surplus for future years. Consequently, its sustainable debt could probably be much greater, particularly because higher surpluses would increase confidence, reduce interest rates and most importantly, increase the demand for base money (which is at a current chronic low).

Equation (11) assumes a floating exchange rate. If a country has a fixed exchange rate, a shift in k will cause a change in international reserves. In this case an increment in k would invariably allow the central bank to reduce its net debt, which in turn may reduce interest rates and have a direct impact on the sustainability of the new debt ratio.

In the floating exchange rate model an increment in k that is not more than offset by the reduction in inflation will increase the sustainability figure. In general, and given positive income growth, it is quite probable that increments in k would have a significant positive impact on the debt sustainability figure.

Equation (9) establishes that *the partial effect on inflation, from changes in the real interest rate, depends on both the real stock of bonds and on income velocity of base money. The higher the debt already incurred and the higher the income velocity of base money, the greater the impact on inflation from a given change in real interest rates. Many times shifts in interest rates affect income growth. Consequently, a policy of sterilizing capital inflows with debt issue may, through an increased interest rate bill and reduced rate of income growth, raise the rate of inflation*¹³.

The impact of b is obvious: the higher the real stock of bonds, the higher the real interest bill that must be financed. Still, the impact of V must also be stressed: the same interest rate bill will have a different impact on inflation depending on the degree of financial deepening, as measured by the real quantity of high powered money.

Given the explicit assumptions in equation (9) if, for example, a country were to keep its stock of bonds constant at 40 percent of GDP, and assuming a real interest rate of 9 percent, together with a growth rate of .03, equation (10) would predict the following inflation rates for alternative values of income velocity (V) and primary balance (d)¹⁴:

¹³ The dangers of “excessive” debt financing have been emphasized in Sargent -Wallace’s (1981) “unpleasant arithmetic”: a tighter monetary policy today can imply, via higher interest rate bill, a higher inflation tomorrow.

¹⁴ It is important to interpret the cells in tables 1 and 2 in relation to “alternative country situation,” for it would be unreasonable to assume that velocity is constant when inflation is changing, or that inflation is constant when velocity is changing.

Table 1
Inflation rates for given primary balances and income velocity of base money
Given: $b = 0.4$; $r = 0.09$; $gy = 0.03$

V	20	15 d	10	5
.02	110	83	54	26
.01	91	68	44	21
.00	71	53	34	16
-.01	51	38	24	11
-.02	31	23	14	7

V is income velocity of base money,
d is deficit, or surplus when negative
inflation rates are annual percentages

Table 1 shows that the same primary deficit (surplus¹⁵) will be consistent with very different inflation rates, depending on income velocity of base money. The inflation elasticity of the demand for money is crucial in determining the level of sustainable debt, given its impact on the inflation tax revenue. A very high elasticity would probably decrease the sustainable debt for increasing inflation.

Table 1 underscores the importance of both the fiscal stance and the income velocity of base money. For example, if two countries had similar interest and growth rates and a velocity of base money of roughly 10, a one percentage point difference in their fiscal deficit would translate into a 10 percentage point difference in their annual inflation rate. The greater the level of velocity, the higher the difference in the inflation rate per percentage change in the deficit. If these countries had an identical fiscal deficit, say 1 percent of GDP, but one had a base velocity of 15 and the other 5, the former would have a yearly inflation of about 68 percent, while the latter about 21 percent.

Based on equation (9), which assumes that the real stock of bonds is constant, the following chart gives the equilibrium value of the real stock of debt for different interest rates and demand for base money. We assume that a primary surplus (-d) equals 2 percent of GDP and inflation equals 10 percent.

¹⁵ A primary surplus can also be consistent with an operational deficit in which case we would also experience inflation.

Table 2
Sustainable Debt for Different Velocities and real interest rates
 $g_P = .10$; $g_Y = 0.03$; $-d = 0.02$

(1/V) r	1/20	1/15	1/10	1/5
.05	.50	.54	.60	.80
.10	.25	.27	.30	.40
.15	.16	.18	.20	.27
.20	.12	.13	.15	.20

Table 1 and 2 call attention to the importance of income velocity of base money. Table 1 shows the importance and inflation effect of the *level* of income velocity of money. Table 2 shows impact of velocity on sustainable debt given other policy variables.

For two countries having a similar surplus of about 2 percent of GDP and yearly inflation and growth of about 10 and 3 percent, according to table 2, if one of the countries experienced a base velocity of 10 and the other 5, the former's sustainable debt would be 60 percent of GDP, while the latter would represent 80 percent.

The higher the demand for base money (the lower its velocity), the higher the "sustainable" real debt for given interest rates. For example (according to row 2 of Table 2), for a real interest rate of 10 percent per year, the sustainable debt would rise from 25 percent to 40 percent of GDP, as velocity decreases from 20 to 5 per year.

Given velocity, the columns in Table 2 show a significant reaction of the equilibrium of debt to changes in real interest rates. For example, if interest rates are reduced by 5 percentage points (from 15 to 10 percent) and velocity is 10, the sustainable debt would consequently increase 10 percentage points of GDP (from .20 to .30). For the same interest rate change (same percentage points change) the increment in sustainable debt is larger, the lower the income velocity of money.

To make the calculation of sustainable debt, it is necessary to consider "reasonable" values of parameters. A one or two year "blip" makes no sense when applying these values to the equations. Consider, for example, the case of Chile in 1995, with an income velocity of base money of 3.3, a primary surplus close to 2 percent of GDP, an inflation of about 8 percent, and an interest rate of 10 percent per year. Its sustainable debt should have been approximately 453 percent of GDP. The same would apply to other countries with atypical figures, for example the Mexican 1995 economic statistics.

Demand for Base Money

Given a constant base multiplier, the demand for real base money, or high-powered money, goes hand in hand with the demand for money. In fact, if we adjust the stock of money for changes in the base multiplier, the changes in the money stock will exactly mirror the changes in base money; and anything that changes the demand for money would change the demand for base money. This is a matter of arithmetic. Consequently, a change in the expected cost of holding money, a change in wealth (or permanent real income), or a change in regime -which would no doubt affect the demand for real money- would also affect the real stock of base money.

Even assuming, as we should, that the multipliers are not constant, there is evidence that there is an stable demand for high-powered money. In fact, the monetary base competes with other conventional measures of money (M1, M2...M4) regarding its relative stability, and may even be a "better" definition of money. The problem with conventional definitions of money is that the empirical determinants of the demand for money are different according to the degree of "moneyness" of its components.

According to Friedman and Schwartz (1970), "The approach stressing the medium-of-exchange function of money has the virtue of possessing a fairly clear empirical counterpart...High powered money, not currency plus demand deposits, is the total that has the ...quality suggested as the relevant criteria." Friedman did not favor any a priori definition of money. His criteria was that money was that part of wealth that separated the act of purchase from the act of sale, and in this sense it was a temporary abode of general purchasing power and a stable function of few variables (Friedman 1969). In this sense the monetary base may be as good a definition as M1 or M3.

These problems led James Lothian (1976) to focus on the demand for monetary base: *"The solution that I propose... is to return to a narrower definition of money, high-powered money alone. The rationale is that since high-powered money is of relatively constant quality over time and space.. specification errors are likely to be less important for high-powered money than for deposit-inclusive totals.... The demand for high-powered money should be more stable than the demand for other monetary aggregates.... I test this proposition by analyzing the demand functions for high-powered money and for various other monetary assets estimated across an international time-section sample spanning forty countries in the postwar period.... I find that high-powered money is unambiguously the most stable total across the countries in my sample."*

According to Lothian (1976), the obvious implication of his findings in international studies in which the stability of the demand for money is a key assumption -for example in the monetary approach to the balance of payments or to exchange rate determination- is that a simpler definition of money might be very fruitful

Moreover, we have found in this paper that real high-powered money is a key factor in the debt sustainability exercise. According to Lothian's analysis, the real base money would be a stable function of a few variables. The issue has not been settled and recently

in the United States there has been a great deal of discussion regarding the revised St. Louis adjusted monetary base¹⁶. Consequently, more research on this important issue is warranted particularly for less developed countries since most empirical evidence has been developed for the United States and some European countries.

Primary fiscal balance: should we increase taxation or reduce expenditures?

There are three channels through which a reduction in government expenditures affect debt sustainability¹⁷.

- (1) Increment in the primary fiscal surplus (or reduction in the deficit)
- (2) Increment in the rate of growth of the economy
- (3) Reduction in the real rate of interest

The primary surplus plays a critical role in the debt sustainability analysis. The only circumstance in which the primary balance would not be important, regarding this issue, would be if the economy's rate of growth were higher than the real rate of interest¹⁸. This is not the usual case.

Most countries in search of fiscal solvency have stressed increased taxation but have done little to reduce expenditures. Nevertheless, higher tax revenues have frequently led to higher expenditures. In fact, the general trend in the Western World has been to increase expenditures (Lindauer, 1988) which according to McDermott and Wescott (1996) is responsible for the fiscal gap in industrial countries. The increase has indeed been striking: from 1960 through 1994 the ratio of government expenditures to GDP in these countries rose to 50 percent from 28 percent while tax revenues increased from 28 percent to 44 percent.

This is an important issue considering that changes in tax revenues or in government expenditures have different effects on the real economy. Even equal increments in tax revenues and expenditure would have a non-neutral effect according to conventional (text-book) analysis of the balance budget multiplier¹⁹. For example, in a full employment situation a balance budget multiplier would lead to increments in interest rates.

Many developing countries, in an effort to achieve macroeconomic stability and to sharpen their competitive edge, many developing countries have privatized most of their

¹⁶ Federal Reserve Bank of Saint Louis, Proceedings of a Symposium held in March 29, 1996. November/December 1996, volume 78, number 6.

¹⁷ The first is direct and straightforward; the other two indirect and depend on other assumptions.

¹⁸ The NPV of addition to income higher than the NPV of addition to debt.

¹⁹ The balance budget multiplier would be smaller (instead of the text-book case of one) if the public substitutes the incremental public expenditures in good and services with a reduction in its expenditure. If substitution is perfect the balance budget multiplier would be zero (Bailey 1971).

state-owned enterprises (SOE) and, in this sense, reduced government expenditures. Nevertheless, the ratio of consolidated government expenditures (federal, state and municipal) to GDP does not appear to have been substantially reduced, at least for most countries in Latin America.

We would expect that if private expenditures in capital formation are more productive (have a higher rate of return) than government expenditures, a switch from government to private expenditures would have a positive effect on the economy's rate of growth²⁰.

Alesina and Perotti (1996) have concluded that the composition of fiscal adjustment is a highly significant variable to its very sustainability. For 1960-64, industrial OECD countries whose fiscal adjustment has chiefly relied on government wage bill and welfare transfers cuts, have experienced a more lasting fiscal adjustment, and have been prone to greater growth, than countries that have relied on tax increments and public investment cuts. Consequently, in adjusting the fiscal accounts to obtain debt sustainability, the composition of the fiscal adjustment would be a crucial variable.

Regarding interest rates, a reduction in government expenditures would tend to decrease rates in as much as a stronger fiscal stance would reduce the risk associated with the government bonds.

The standard analysis concludes that an increase in taxation reduces the real interest rate in so far as desired private savings falls less than the tax increment, so that desired national savings increase. This shift to the right in the savings schedule would reduce interest rates and increase investment²¹.

There is another school of thought that claims that the pattern of taxation is irrelevant and that the real effect is given by the pattern of expenditures. This literature has been developed in the context of discussing budget deficits, and is based on the Ricardian theory. This hypothesis claims that what matters to the public is the present value of taxes and not its financing via debt or taxation. This hypothesis has been revived by Barro (1979, 1990): *"the substitution of a budget deficit for current taxes... has no impact on the aggregate demand for goods. In this sense budget deficits and taxation have equivalent effects on the economy-hence the term Ricardian equivalence theorem"*. The Ricardian/Barro analysis tells us that by increasing taxation, without changing expenditures, nothing has changed, except the government's debt/tax mix. Nothing has changed because the present value of future taxes has not changed.

²⁰ There is no reason to assume a change in the private sector's marginal propensity to save.

²¹ In this conventional analysis a tax cut would have the opposite effect: increase aggregate demand for consumption goods, a reduction in desired national savings (with some increment in desired private savings), and a rise in interest rates. In this situation, the conventional analysis alleges that the fiscal deficit produces a crowding out effect due to the increment in the interest rates.

This matter has yet to be resolved. As Al Harberger allegedly mentioned: *"I know of no one who has canceled his vacation because the government has increased its bond issue, but I know people who have canceled their vacation because the government increased taxes"*. Yet the empirical evidence seems to tilt in favor of the Ricardo/Barro approach. A survey of empirical studies on the deficit-interest rate *"found that only four of twenty-one studies provided evidence supporting a positive, statistically significant impact of deficits on interest rates....another ten studies found no evidence the remaining seven studies produced mixed results that also sometimes indicated no link"* (Bradly 1986).

Bradley (1986) links interest rate changes to government expenditures: *"In this article we demonstrate that a crucial difference exists between the economic impacts of increased government spending and the economic impacts of increasing the bond stock. Using a simple dynamic model, we find that increases in the stock of government bonds, by themselves, do not force interest rates. When the debt increase is caused by a rise in spending, however, we find that, after a lag, both interest rates..... rise."*

Barro (1990) draws a distinction between temporary and permanent variations in government purchases, arguing that the interest rate and outputs are mostly affected by temporary changes in government expenditures.

The issue concerning the impact of government deficit and fiscal policy on interest rates is far from being resolved. Most of the empirical evidence is inconclusive and pertains mostly to the US. Nevertheless, it seems safe to conclude that, at least for Latin America, an increment in the primary surplus would tend to reduce interest rates due to its contribution to reducing country risk. Also, a reduction of government expenditures, for example, through privatization of SOEs or reduction in bloated bureaucracies, would help to (a) increase the rate of income growth (allocation effect) and (b) reduce the interest rate (crowding out effect).

Description of Some Debt Statistics for Selected Countries

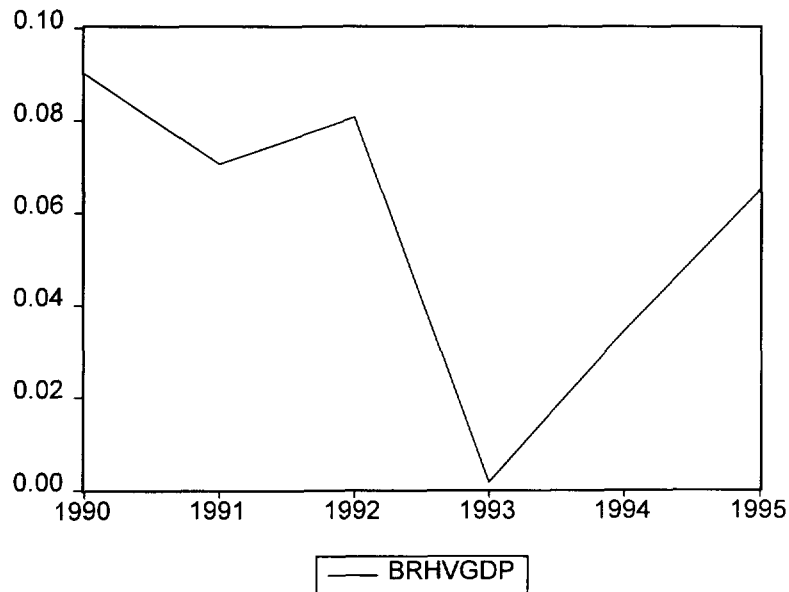
The remaining sections will present some variables relevant to the debt sustainability of Brazil, Chile and Costa Rica, with passing references to Germany and Argentina.

Brazil

Brazil is an interesting country given its broad experience with inflation, debt problems and extensive debt-financing strategies. In the previous debt sustainability exercise, we have demonstrated that k is a key variable. The following illustration will show the evolution of k for Brazil.

Chart 1

Brazil: Base money
Ratio to GDP

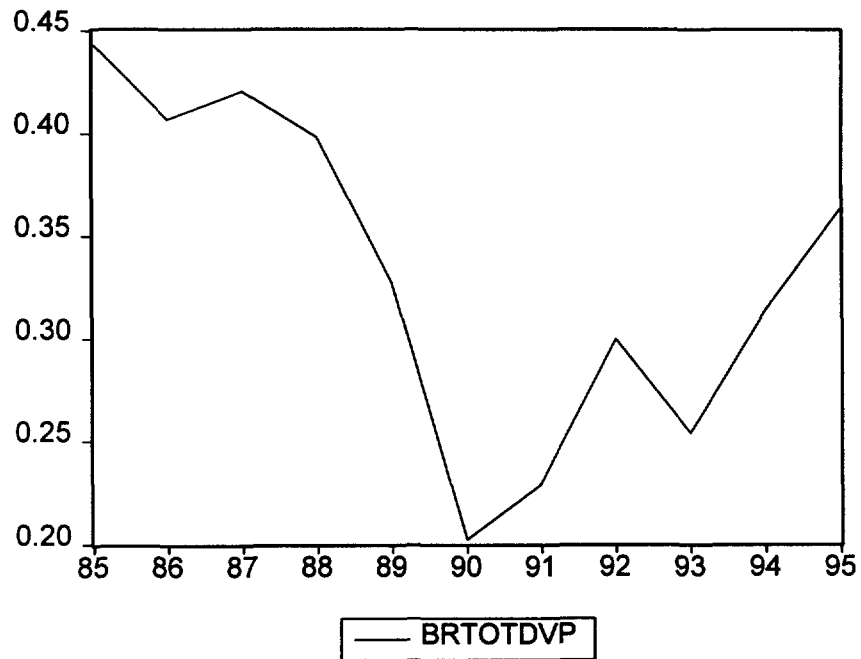


Source: IMF, International Financial Statistics

Chart 1 shows important fluctuations in the demand for real base money, indicating a very low average: roughly 4 percent of GDP.

The following example demonstrates the evolution of total debt (domestic and foreign) as a ratio to GDP. As evidence suggests, a sharp drop was experienced in 1990, proceeded by a substantial recovery until 1995, with the exception of 1993 when the ratio sustained a slight stumble.

Chart 2
Brazil: Total Debt ratio to GDP

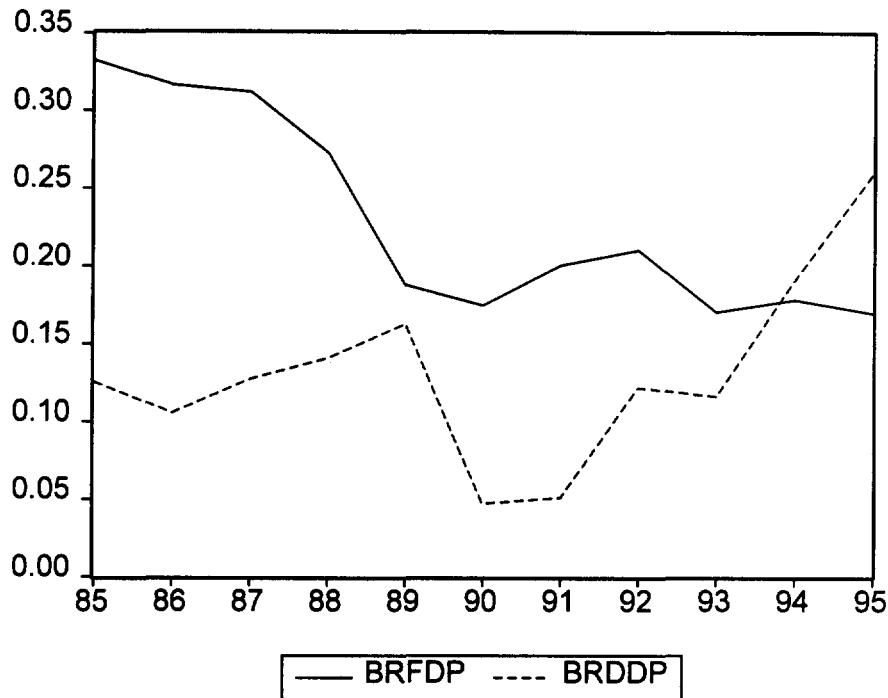


Sources: Foreign Debt, World Bank debt tables.
Domestic Debt: Central Bank of Brazil

Brazil has chronically suffered from three related ailments: lack-luster fiscal performance, high interest rate on its debt, and high velocity of circulation of money. Nonetheless, it had one thing in its favor — a relatively high rate of growth.

The next two charts demonstrate Brazil's changing strategy regarding domestic and foreign debt financing.

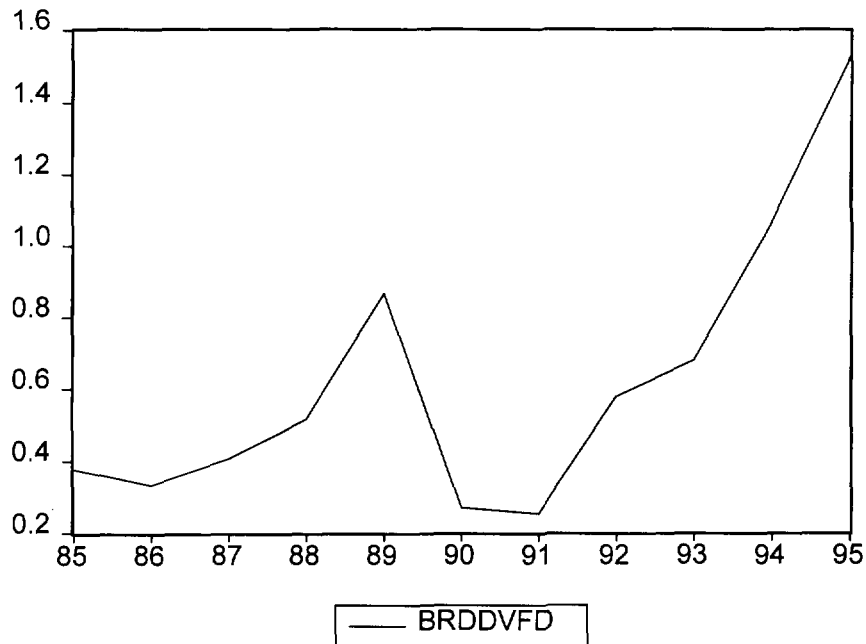
Chart 3
Brazil: Domestic and Foreign Debt
 Ratios to GDP



Broken line: Domestic Debt
 Solid line: Foreign Debt
 Sources: Foreign Debt, World Bank debt tables
 Domestic Debt, Central Bank of Brazil

As the chart indicates, as of 1992 there has been a critical shift in the strategy of domestic and foreign financing of the primary deficit: domestic debt increased dramatically from about 5 percent of GDP in 1991 to 26 percent in 1995. This direction is traced to the policy of capital inflows sterilization (to avoid exchange rate appreciation), and to tight monetary policy associated with the "Real Plan." The switch in debt management is exhibited in a more striking fashion in the next chart, presenting the ratio of domestic debt to foreign debt.

Chart 4
Brazil: Ratio of Domestic Debt to Foreign Debt



Sources: Foreign Debt, World Bank debt Tables
Domestic Debt, Central Bank of Brazil

Chart 4 shows a significant shift in Brazil's debt management strategy. The average ratio of domestic to foreign debt for 1985-1992 was about 0.4, and by 1995 climbed to 1.5, signaling an impressive change in the debt mix.

Chile

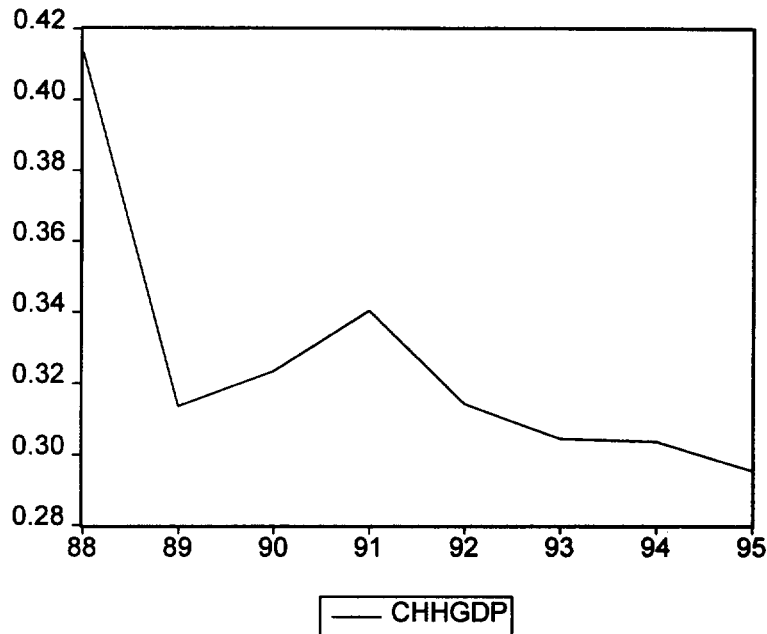
As a contrast to Brazil's strikingly low demand for real base money and its subsequent effect on the sustainable debt figure, we consider Chile. Applying the "reasonable" values for this nation to equation (11) results in a completely different picture. While base velocity in Brazil is about 17 per year, in Chile it is roughly 3.3 per year ($k=.3$).

For Chile we will assume that velocity will remain the same as its current level, and that its long-term income growth will be reduced from its likely unsustainable current level to about 5 percent per year.

$k = .30$; $gP = .07$; $r = .08$; $gy = .05$; $d = -0.01$ (primary surplus), with these parameter values we obtain **$b = 1.33$**

The following chart demonstrates the evolution of k for Chile.

Chart 5
Chile: Base Money
Ratio to GDP



Source: IMF, International Financial Statistics

Even though Chile has experienced a downward trend in k , its value is still quite high, translating into high revenues from seignorage. For example, if we merely consider the inflation tax, multiplying the 1995 real stock of base — which was about 30 percent of GDP — by the inflation rate of the same year (about 8 percent), the result is an inflation tax of roughly 2.4 percent of GDP. This is without considering income growth.

Germany

For the sake of comparison with a developed country, we consider **Germany**, and assume a zero primary balance and the following parameters:

$$gP = .04; r = .04; gy = .02; k = .10$$

Equation (11) yields in this case a sustainable $b = .30$

This value is, without doubt, acutely low. According to the Maastricht treaty, by 1999 countries wishing to lock into the EMU fixed exchange rate system are requested (among other things) to have a debt to GDP ratio smaller than 0.60. Germany, like Brazil, suffers from a low k , which implies low revenue from seignorage. Hence, Germany is compelled to make a greater fiscal adjustment than otherwise would have been the case.

Next Chart 6 shows the evolution of k for Germany

Chart 6
Germany: Base Money
Ratio to GDP



Source: IMF, International Financial Statistics

This diagram shows a substantial variability in German demand for base money, which is in fact quite interesting given its strong record of stability.

Costa Rica

Costa Rica is an interesting example of the costly switch from foreign to domestic financing. One reason can be traced to the sterilization of capital flows. From 1989 through 1995 foreign reserves of the Monetary Authorities increased twofold (IFS). Also, and most importantly, the operational deficit was 4.8 percent of GDP in 1994, 2 percent in 1995 and about 3.2 percent in 1996. This was mainly due to the high cost of real interest rates, as displayed in the following table:

Table 5
Costa Rica: Interest Payments, ratios to GDP
percentages, domestic and foreign debt

Year	Int/GDP
1993	3.1
1994	4.1
1995	5.5
1996	6.4

Source: IMF

Table 6
Costa Rica: Financing Operational Deficits

Year	Operational Deficits	%FFinancing	%DDFinancing
1991	9.0	16	47
1994	63.1	10	70
1995	33.8	-22	146

Source: IMF

Operational deficit is in Bn Colones; 1992 and 1993 experienced operational surpluses

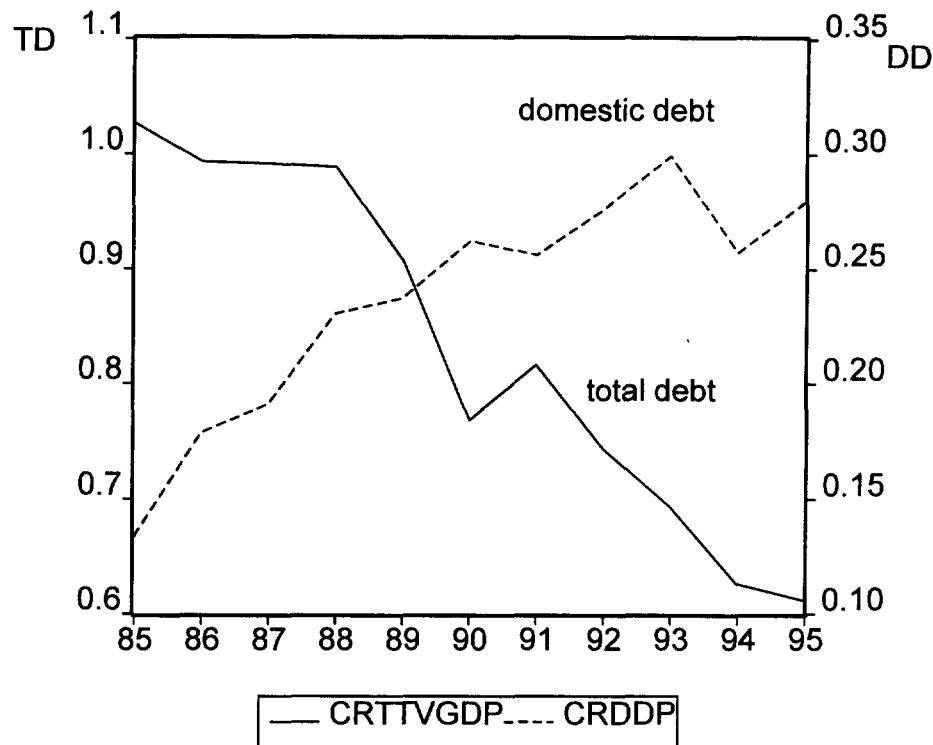
Table 6 shows that Costa Rica has been financing a large share of its operational deficit with domestic debt. Particularly crucial was 1995 in which a share of the increment in domestic debt was used to reduce foreign borrowing.

Applying some experimental values to equation (9), **Costa Rica** shows a sustainable debt of 59 percent of GDP²².

The following chart depicts the ratio of total debt to GDP and the ratio of Domestic Debt to GDP.

²² $gP = .20$; $gy = .03$; $k = .16$; $r = .15$

Chart 7
Costa Rica: Total and Domestic Debt
Ratios to GDP

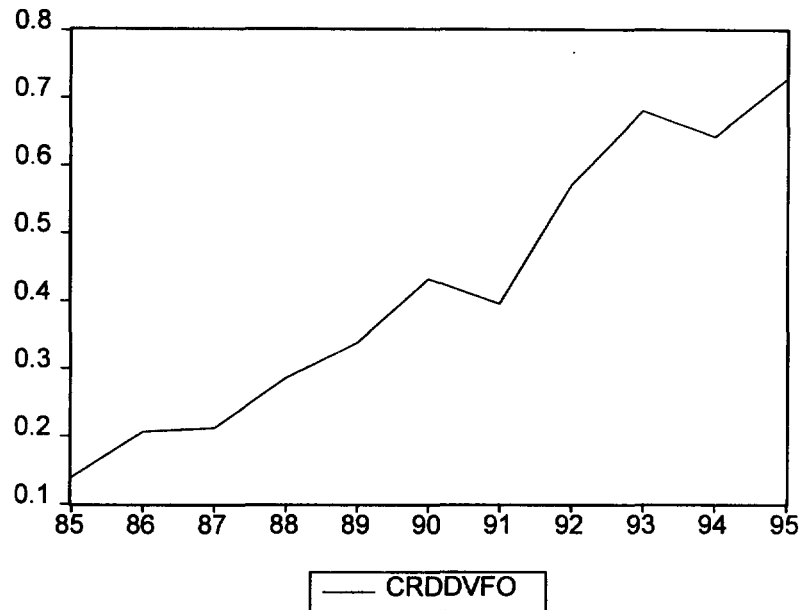


Source: IMF, International Financial Statistics

If we only focus on the total debt to GDP ratio, we are tempted to be optimistic. True, the total debt to GDP decreased from 100 percent of GDP in 1985 to about 61 percent in 1995, which approximates the “sustainable” ratio calculated by equation (9). Nevertheless, this picture is deceiving. First, a large share of the fall in the foreign debt ratio to GDP is the product of the exchange rate appreciation, which increases dollar GDP without changing the actual dollar debt figure. Second, the fiscal situation has deteriorated significantly and interest rates have increased substantially. The primary 1996 surplus of 3.2 percent of GDP could not compensate a large interest rate bill of 6.4 percent of GDP, which produced an operational deficit of 3.2 percent of GDP.

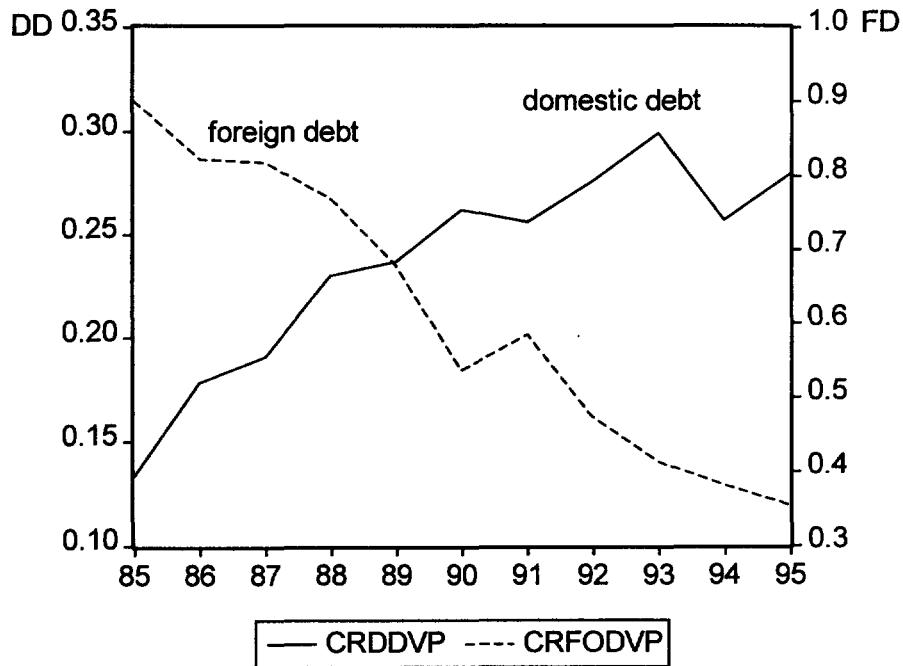
So far, Costa Rica has had a relatively low income velocity of money (about 6 per year over M2). If this were to change, as expected if the fiscal situation does not improve, this nation would have a proportionally higher level of inflation if it wanted to keep its debt ratio at “reasonable” levels.

Chart 8
Costa Rica: Ratio of Domestic to Foreign Debt



Source: IMF

Chart 9
Costa Rica: Foreign and Domestic Debt
Ratios to GDP

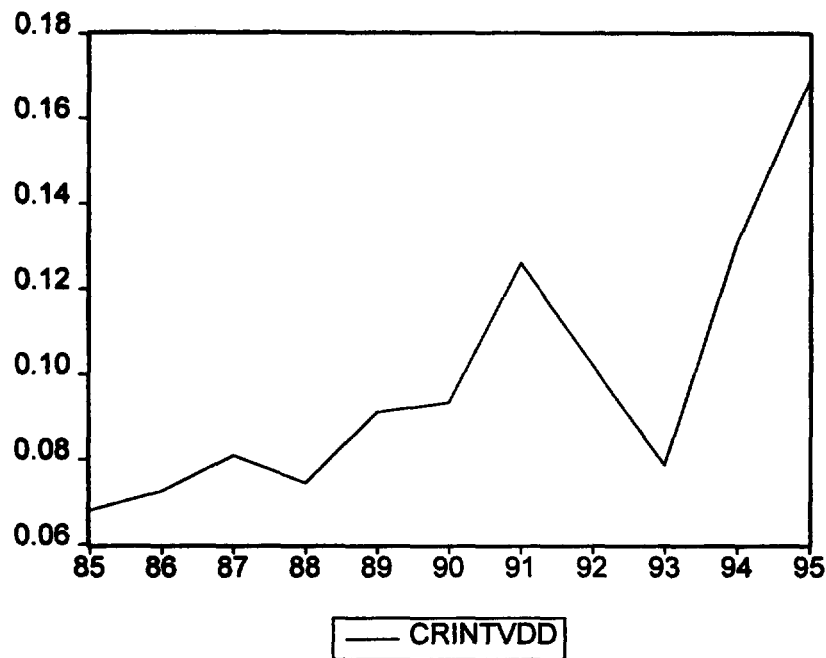


Source: IMF

The above cited chart shows that domestic debt increased from 13 percent in 1985 to almost 30 percent of GDP in 1995.

The real interest rate is a major variable in all debt sustainability exercises. The following presents the ratio of the interest rate bill to the stock of debt.

Chart 10
Costa Rica: Ratio of Interest Payments to Domestic Debt

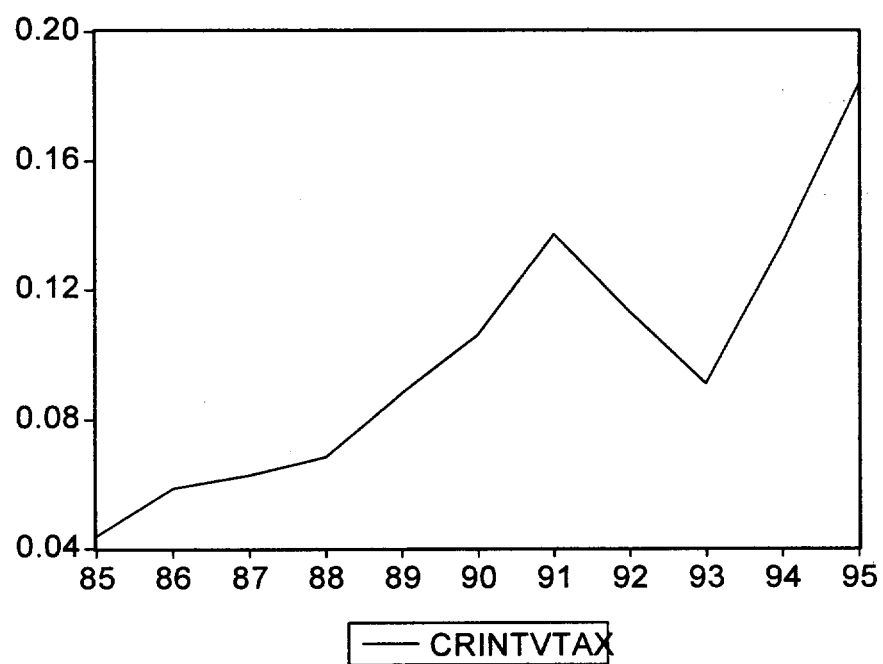


Source: IMF

Chart 10 shows that the real interest rate has become a major factor in determining the probability of sustaining the current stock of debt in Costa Rica. In this chart 1992 and 1993 appear to be outliers. These were years of operational surpluses, which were followed by years of significant deficits.

The following illustration exhibits the huge interest rate burden for the Costa Rican Treasury. In 1995 interest payments represented almost 20 percent of Treasury's tax revenues.

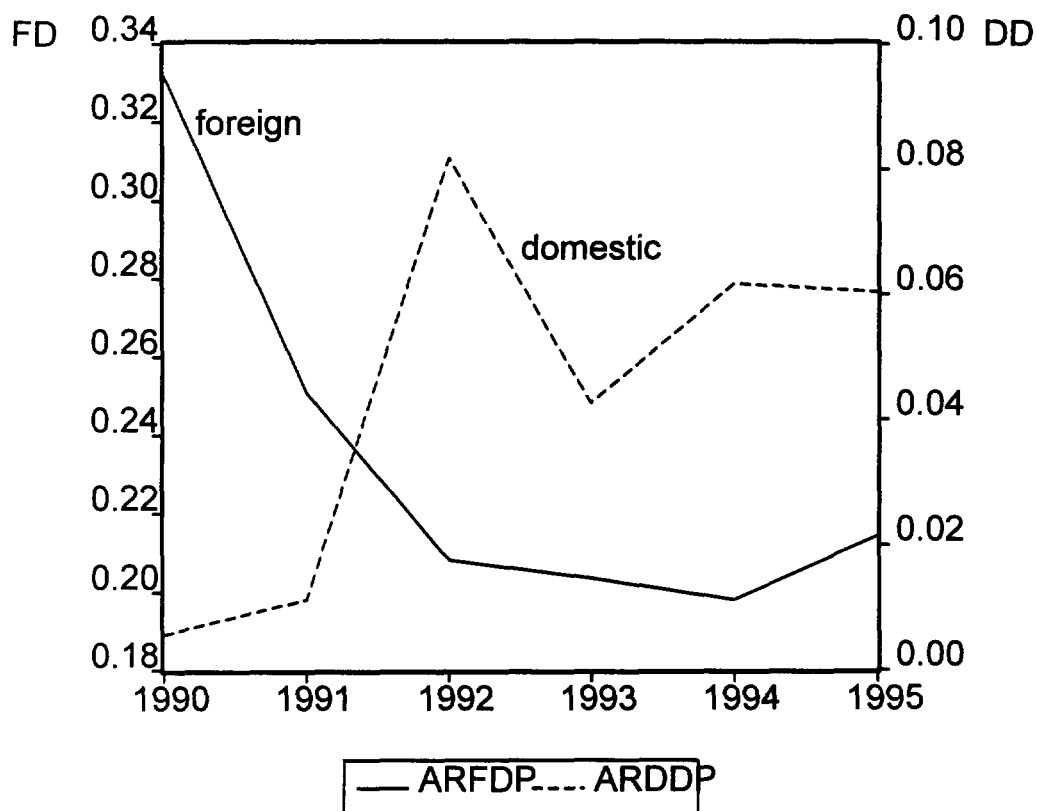
Chart 11
Costa Rica: Ratio of Interest Payments to Tax Revenues
Domestic Debt only



Argentina

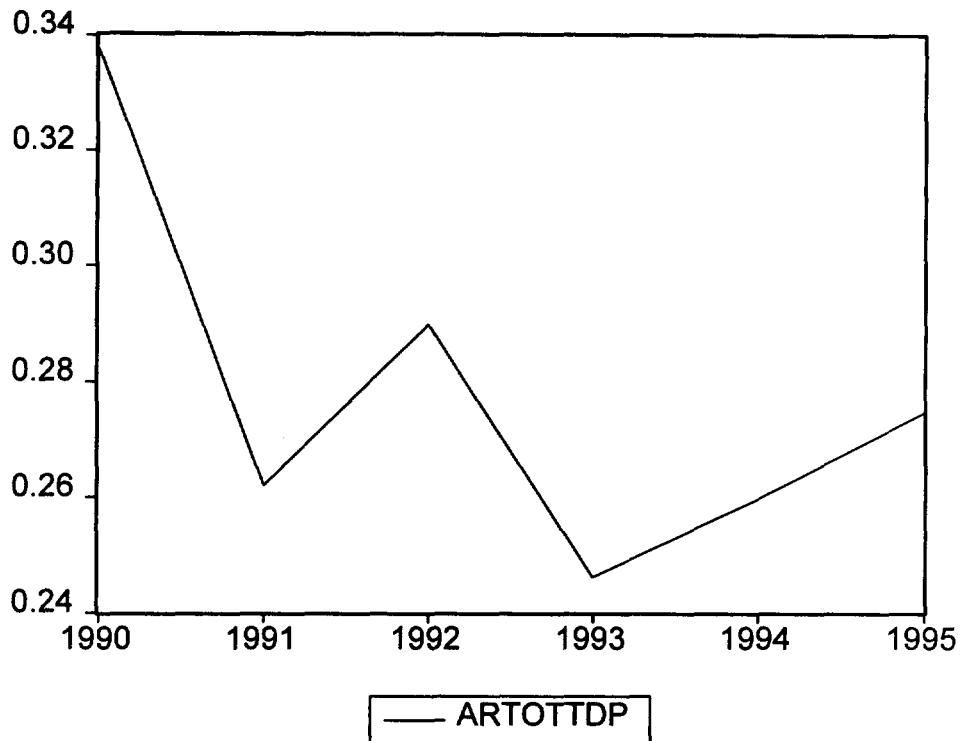
Argentina has had a currency board since 1991. In this endogenous money system, the demand for base is important because increments in k imply an increment in the amount of Central Bank foreign assets. In this case the Central Bank's seignorage equals the interest on these international reserves. Equation (11) cannot be directly applied to a completely fixed exchange rate system like that of Argentina, since this equation has the explicit assumption that the rate of inflation is determined by the exogenous monetary base. The following charts present the evolution of Argentina's domestic and foreign debt, as well as total debt to GDP ratio.

Chart 12
Argentina: Domestic and Foreign Debt
Ratios to GDP



Sources: Foreign Debt, World Bank debt tables
Domestic Debt, Central Bank

Chart 13
Argentina: Total Debt
Ratio to GDP

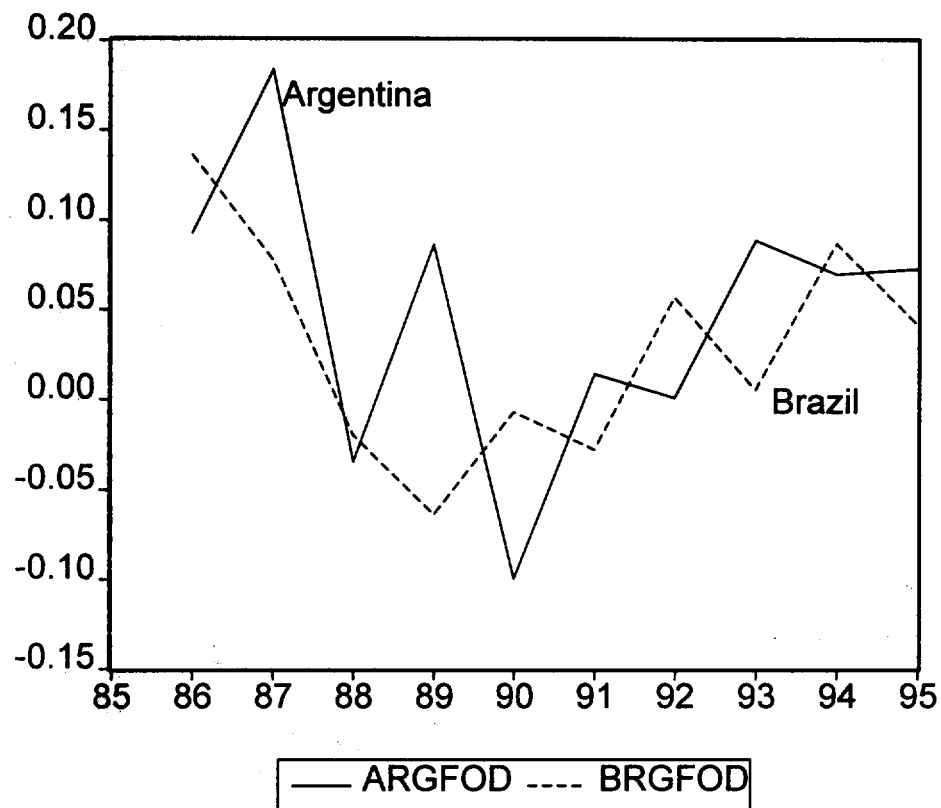


Source: World Bank debt tables and Central Bank

While Argentina has had a strict, fixed exchange rate system, Brazil, in contrast, has had what has been referred to as a dirty peg, or sliding band. And although Argentina has not mimicked the “sterilization” policy of Brazil, both have experienced a remarkably similar pattern in the rate of change in their foreign and total indebtedness, as the following charts will exhibit.

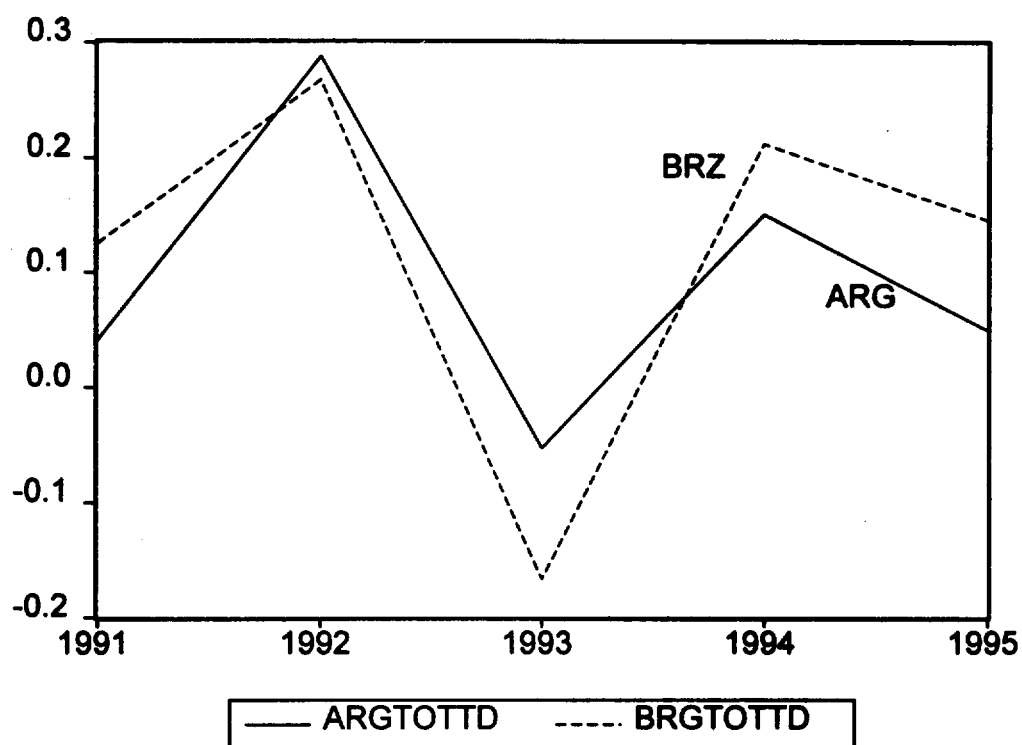
Chart 14

Argentina and Brazil
Rate of change of foreign indebtedness



Sources: World Bank Debt Tables and Central Banks

Chart 15
Argentina and Brazil
Rate of Change of total real debt



Sources: World Bank debt tables and Central Banks

Conclusions

At the core of the debt sustainability analysis is the demand for real monetary base, the primary fiscal surplus, the real interest rate, and the rate of income growth, all of which are mutually determined by other variables. This paper puts special emphasis on one such variable virtually disregarded in current literature on debt sustainability — the demand for monetary base. Any effort by policymakers to instill confidence in such a way as to secure an increased demand for the monetary base would be a step forward to solving the debt dilemma.

High interest rates on domestic debt are also an issue of concern. Many Latin American countries are switching to (domestic) debt financing as a means of sterilizing the effect of capital inflows on the real exchange rate. Yet, this trend may, in turn, affect the sustainability of their debt through its impact on the real interest rate and reduced income growth (because high interest rates depress economic activity). Its ramifications may also extend to the demand for real base if the induced higher operational deficit generates inflationary expectations.

Primary fiscal surplus is a key variable in the calculation of sustainability. A permanent increase in the primary fiscal surplus would increase debt sustainability if other variables remain unchanged. Furthermore, a permanent increase in the fiscal primary surplus *through expenditure reduction* would have an important effect on debt sustainability given its tendency to:

- reduce the real interest rate (through crowding out reduction)
- increase income growth (through increased efficiency in resource allocation and reduced interest rates)
- increase the demand for monetary base (as a result of reduced inflationary expectations).

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